CLAIMS

What is claimed is:

1. A method comprising:

separately routing a metal and one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent for mixing and application to a wafer;

in-line heating the metal and the one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent to an application temperature, while they are being routed; and

in-line mixing the heated metal and the heated one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent substantially just prior to application to the wafer; and

applying the mixture of the heated metal and the heated one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent to the wafer.

2. The method of claim 1, wherein the metal is a selected one of Co, Cu, Ni, Fe, Ag, Au, Pt, Pd and Ru.

3. The method of claim 1, wherein either a selected one of a citric acid and EDTA is used as a complex agent, a selected one of NH4Cl and a boric acid is used as a buffer, a selected one of KOH and TMAH is used at a pH adjuster, or a selected one of DMAB, hypophosphite, formaldehyde, and glyoxylic acid is used as a reducing agent.

4. The method of claim 1, wherein said in-line heating comprises heating the metal and the one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent to an application temperature in a range of 30 C – 90 C.

5. A system comprising:

a chamber to apply a plating solution to plate one or more wafers;

a plurality of tanks to separately hold a metal and one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent; and

a piping system having a plurality of segments, including a plurality of in-line heaters for a subset of the segments, to separate route, in-line heat, and mix to form the plating solution, substantially just prior to application, the metal and the one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent, in-line heat the metal and the one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent.

6. The system of claim 5, wherein the plurality of tanks comprise a tank to store a selected one of Co, Cu, Ni, Fe, Ag, Au, Pt, Pd and Ru.

7. The system of claim 5, wherein the plurality of tanks comprise a tank to store either a selected one of a citric acid and EDTA to be used as a complex agent, a selected one of NH4Cl and a boric acid to be used as a buffer, a selected one of KOH and TMAH to be used at a pH adjuster, or a selected one of DMAB, hypophosphite, formaldehyde, and glyoxylic acid to be used as a reducing agent.

8. The system of claim 5, wherein the in-line heaters are capable of in-line heating the metal and the one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent to an application temperature in a range of 30 C – 90 C.

9. A method comprising:

heating DI water to a predetermined temperature;

pre-heating one or more pipeline segments, a chamber and a wafer to the predetermined temperature employing the heated DI water;

in-line mixing a concentrated plating solution with the heated DI water in said pre-heated one or more pipeline segments to form a diluted, but heated plating solution, and routing the diluted, but heated plating solution to the chamber; and

applying the diluted, but heated plating solution to the wafer.

10. The method of claim 9, wherein the DI water having a surfactant mixed in, and the method further comprises mixing the DI water with the surfactant.

11. The method of claim 10, wherein the surfactant is a selected one of RE 610, Triton X100, polyethers, and polyoxyethylne.

12. The method of claim 1, wherein said heating of the DI water comprises heating the DI water to a temperature in a temperature range of 70 C – 100 C.

13. The method of claim 9, wherein said in-line mixing comprises mixing 1 to 10 parts of the DI water with 1 part of the concentrated plating solution.

14. The method of claim 9, wherein said applying comprises applying 100 ml/min – 10l/min of the diluted, but heated plating solution to the wafer, rotating with an angular speed greater than 10 revolutions per minute.

15. A system comprising:

a chamber to apply a plating solution to plate one or more wafers;

a heater to heat DI water to a predetermined temperature; and

a piping system having one or more pipe segments coupled to the heater and the chamber, to allow at least a selected one of the one or more pipe segments, the chamber and the wafer to be heated by the DI water, to in-line mix a concentrated plating solution with the heated DI water to form said plating solution, and to route said plating solution to said chamber.

16. The system of claim 15, wherein the DI water having a surfactant mixed in, and the piping system further facilitates in-line mixing the DI water with the surfactant.

17. The system of claim 16, wherein the surfactant is a selected one of RE 610, Triton X100, polyethers, and polyoxyethylne.

18. The system of claim 15, wherein the heater is equipped to heat the DI water to a temperature in a temperature range of 70 C – 100 C.

19. The system of claim 15, wherein the piping system is designed to allow in-line mixing of 1 to 10 parts of the DI water with 1 part of the concentrated plating solution.

20. The system of claim 15, wherein the piping system is designed to allow a flow of the plating solution at 100 ml to 10 l per minute to be applied to a wafer, rotating with an angular speed greater than 10 revolutions per minute.

21. A method comprising:

forming a plating solution for plating a wafer;

configuring a piping system to route the plating solution for qualification analysis;

performing said qualification analysis;

determining whether the plating solution passes the qualification analysis; and

re-configuring the piping system to route the plating solution for application on the wafer, if the plating solution passes the qualification analysis.

22. The method of claim 1, wherein said forming comprises mixing a metal with one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent.

23. The method of claim 22, wherein said forming further comprises mixing DI water with said mixture of a metal and at least a selected one of one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent.

24. The method of claim 22, wherein the method further comprises mixing DI water and a surfactant, and said forming further comprises mixing said mixture of DI water and surfactant with said mixture of a metal and at least a selected one

of one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent.

25. The method of claim 21, wherein said forming comprises heating the plating solution to an application temperature.

26. The method of claim 21, wherein said forming comprises forming said plating solution in a selected one of said piping system and a mixing tank.

27. The method of claim 21, wherein said configuring of a piping system comprising configuring a valve of the piping system to route the plating solution onto a first path for said qualification analysis, and said re-configuring of the piping system comprising re-configuring the valve to route the plating solution onto a second path for application.

28. The method of claim 21, wherein said performing of a qualification analysis comprises performing one or more electroanalyses for one or more reaction kinetics.

29. The method of claim 28, wherein said performing of one or more electroanalyses for one or more reaction kinetics comprises performing one or more electroanlyses for one or more of adsorption, nucleation, deposition rates, pH balance, and particles generation, and comparing the result(s) against one or more corresponding qualification metrics.

30. The method of 14, wherein said performing of one or more electroanalyses for one or more reaction kinetics comprises performing one or more of

a Quart Crystal Microbalance (QCM) analysis,
an Open Circuit potential (OCP) analysis,
a pH analysis,
a particle count analysis, and
a UV-VIS analysis

31. A system comprising:
an electroanalytical subsystem equipped to qualify a plating solution;
a chamber to apply a plating solution to plate one or more wafers; and
a piping system having a configurable value, a first route coupling the valve and the electroanalytical subsystem, and a second route coupling the valve and the chamber, allowing a plating solution to be routed to the electroanalytical subsystem for qualification analysis, prior to being routed to the chamber for application.

32. The system of claim 31, wherein the system further comprises a plurality of tanks to correspondingly store a metal and one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent, and the piping system further comprises a third plurality of routes to mix in-line the metal with the one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent to form the plating solution.

33. The system of claim 32, wherein the plurality of tanks comprise a tank to store DI water, and the third plurality of routes further mix in-line said DI water with said mixture of a metal and at least a selected one of one or more of a

complexing agent, a buffer, a pH adjuster and a reducing agent, to form the plating solution.

34. The system of claim 32, wherein the plurality of tanks comprise tanks to correspondingly store DI water and a surfactant, and the third plurality of routes further mix the DI water with the surfactant, and then mixes said mixture of DI water and surfactant with said mixture of a metal and at least a selected one of one or more of a complexing agent, a buffer, a pH adjuster and a reducing agent, to form the plating solution.

35. The system of claim 31, wherein the system further comprises a heater disposed upstream of the valve to heat the plating solution to an application temperature.

36. The system of claim 31, wherein the system further comprises a controller coupled to the electroanalytical subsystem and the valve, to configure the valve based at least in part on result of the qualification analysis.

37. The system of claim 36, wherein the controller is equipped to compare the result(s) of the qualification analysis to one or more qualification metrics.

38. The system of claim 31, wherein said electroanalytical subsystem comprises one or more modules to perform one or more electroanalyses for one or more reaction kinetics.

39. The system of claim 31, wherein said electroanalytical subsystem comprises one or more modules to perform one or more electroanlyses for one or more of adsorption, nucleation, deposition rates, pH balance, and particles

generation, and comparing the result(s) against one or more corresponding qualification metrics.

40. The system of claim 31, wherein said electroanalytical subsystem comprises one or more modules to perform one or more of

a Quart Crystal Microbalance (QCM) analysis,

an Open Circuit potential (OCP) analysis,

a pH analysis,

a particle count analysis, and

an UV-VIS analysis